

AEDG Implementation Recommendations: Service Water Heating

The Advanced Energy Design Guide (AEDG) seeks to achieve 30 percent savings over Standard 90.1-1999. This guide focuses on improvements to small office buildings, less than 20,000 square feet. The recommendations below are adapted from the implementation section of the guide, and should be used in cooperation with the whole document.* The full design guide is available from the ASHRAE website, [Advanced Energy Design Guide for Small Office Buildings](#).

Service Water Heating Types

The service water heating equipment for the AEDG considers the type of fuel source used for the HVAC heating system. The AEDG does not cover systems that use oil, hot water, steam, or purchased steam for generating service water heating.

System Description

1. Gas-Fired Storage Water Heater: Forced-draft type water heater with a vertical or horizontal water storage tank. A thermostat controls the delivery of gas to the heater's burner. The heater requires a vent to exhaust the products of combustion.
2. Gas-Fired Instantaneous Water Heater: Atmospheric-type water heater with minimal water storage capacity. Control is generally by means of a flow switch that controls the burner and will have a modulating fuel valve that varies fuel flow as water flow changes. The heater requires a vent to exhaust the products of combustion. An electronic ignition is required to avoid the energy losses from a standing pilot.
3. Electric Resistance Storage Water Heater: Water heater consisting of a vertical or horizontal storage tank with one or more immersion heating elements. Thermostats controlling heating elements may be of the immersion or surface-mounted type.
4. Electric Resistance Instantaneous Water Heater: Compact, under-cabinet or wall-mounted type with insulated enclosure and minimal water storage capacity; a thermostat controls the heating element, which may be of the immersion or surface-mounted type. Instantaneous, point-of-use water heaters should provide water at a constant temperature regardless of input water temperature.

Sizing

The water heating system should be sized to meet the anticipated peak hot water load, typically about 0.4 gallons per hour per person in the average office building. The hot water demand will be higher if showers or other high-volume uses exist and these should be accounted for in sizing equipment. The supply water temperature should be no higher than 120 degrees F to avoid injuries due to scalding.

Equipment Efficiency

Efficiency levels are provided in the guide for gas instantaneous, gas-fired storage, and electric resistance storage water heaters. For gas-fired instantaneous water heaters, the energy factor and thermal efficiency levels correspond to commonly available instantaneous water heaters without standing pilot lights.

The gas-fired storage water heater efficiency levels correspond to condensing storage water heaters. High-efficiency, condensing gas storage water heaters (energy factor > 0.90 or thermal efficiency > 0.90) are alternatives to the use of gas-fired instantaneous water heaters. The construction of a condensing water heater as well as the water heater venting must be compatible with the acidic nature of the condensate for safety reasons. Disposal of the condensate should be done in a manner compatible with local building code.



Efficiency metrics for high-efficiency electric storage water heaters (energy factors) are also provided for in the AEDG. These efficiency metrics represent premium products that have reduced standby loss. The equation for energy factor shown in the climate zone recommendation tables corresponds to electric water heaters with the following Energy Factors:

Storage Volume	EF Requirement
30 gal	0.95
40 gal	0.94
50 gal	0.93
65 gal	0.91
75 gal	0.90
80 gal	0.89
120 gal	0.85

Instantaneous electric water heaters are an acceptable alternative to high-efficiency storage water heaters. Electric instantaneous water heaters are more efficient than electric storage water heaters, and point of use versions will minimize piping losses. However, their impact on building peak electric demand can be significant and should be taken into account during design. Where unusually high hot water loads (e.g., showers) are present during periods of peak electrical use, electric storage water heaters are recommended over electric instantaneous for those end uses.

Location

The water heater should be located close to the hot water fixtures to avoid the use of a hot water return loop or the use of heat tracing on the hot water supply piping. Where electric resistance heaters are used, point-of-use water heaters should be considered when there are a low number of fixtures or where they can eliminate the need for a recirculating loop.

Pipe Insulation

All service water heating piping should be installed in accordance with accepted industry standards. Insulation levels should be in accordance with the AEDG recommended, and the insulation should be protected from damage. Include a vapor retardant on the outside of the insulation.

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